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Brickner et al.

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(54) **SYSTEM FOR DEFINABLE SINGLE LEVER CONTROL SHIFT PATTERN JOINT**

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(52) **U.S. Cl.** ..... **74/471 XY**; 74/473.33; 403/57

(58) **Field of Search** ..... 74/471 XY, 473.21, 74/473.33; 403/53, 57; 137/636.2

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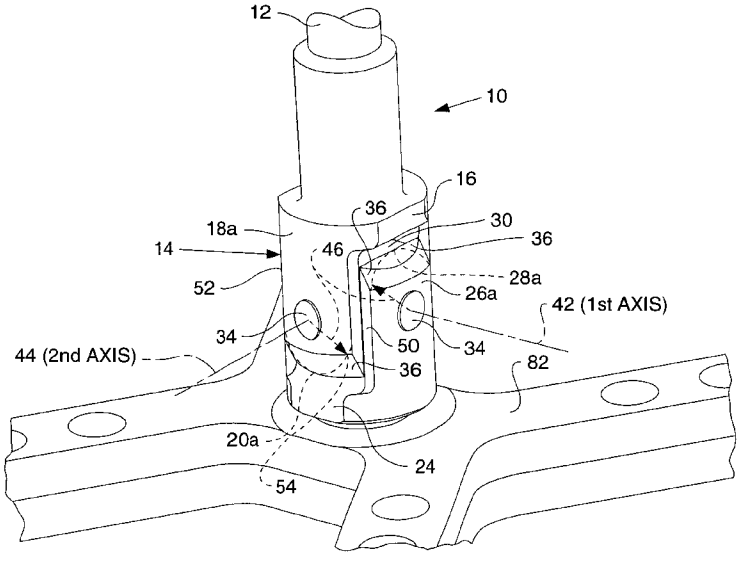
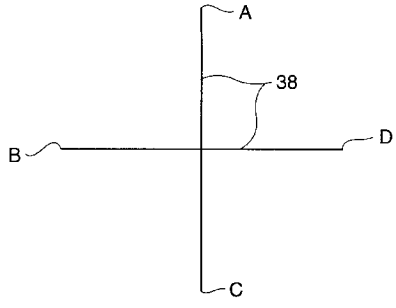
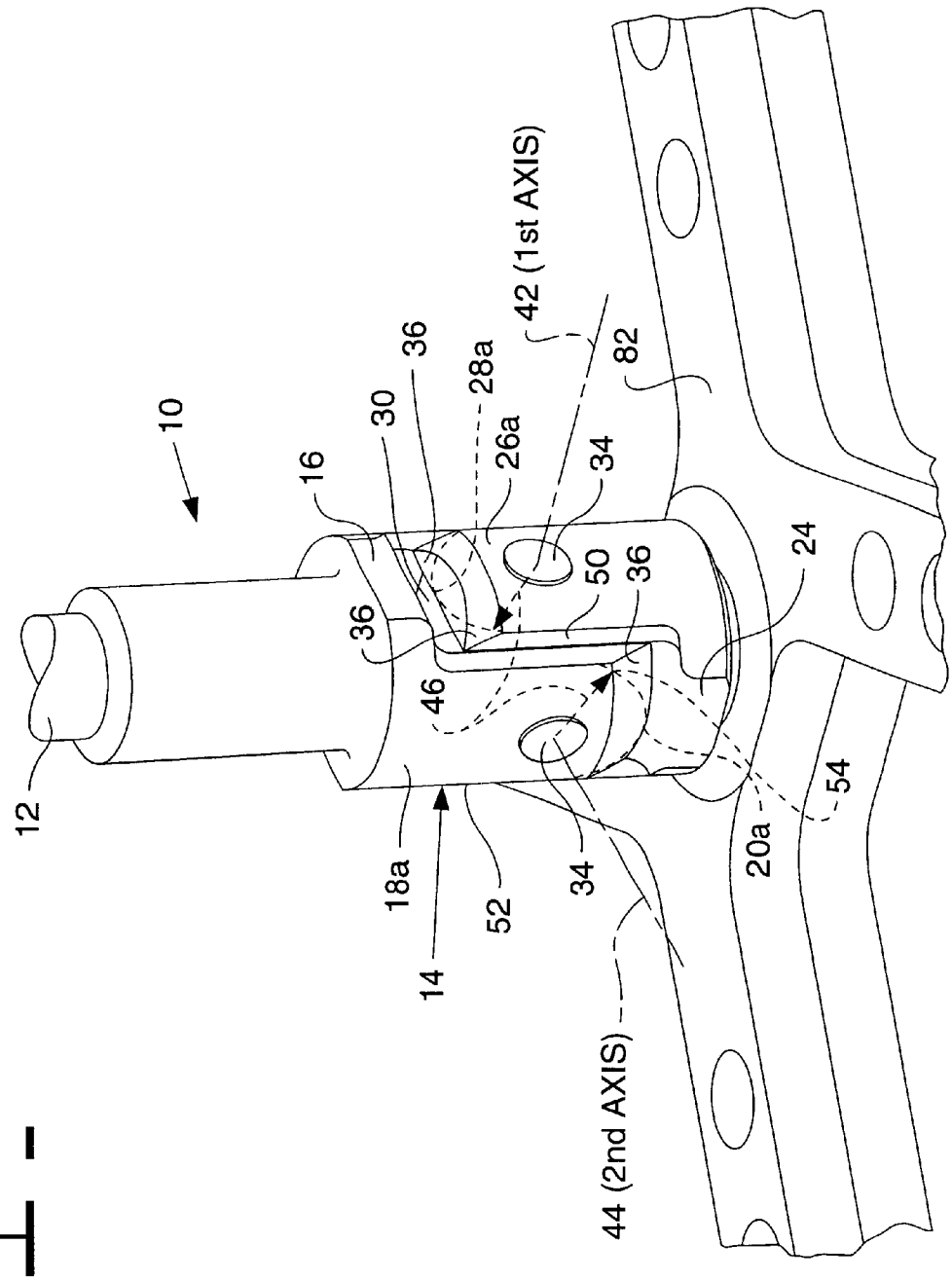
(57) **ABSTRACT**

A single lever control assembly that limits motion due to the inherent design of the assembly. In other words, no additional components are required to limit the motion of the single lever control assembly. The assembly includes two U-shaped members each having a base and parallel legs extending from the base, a lever connected to one of the U-shaped members and a pivot block interconnecting the parallel legs for allowing the U-shaped members to rotate relative to one another. The assembly has at least one of the parallel legs having a projection that engages one of the parallel legs of the other U-shaped member. In general, the single lever control assembly is a type of modified universal joint whose movement is limited by a projection.

17 Claims, 5 Drawing Sheets






10
12
14
16
18a
20a
24
26a
28a
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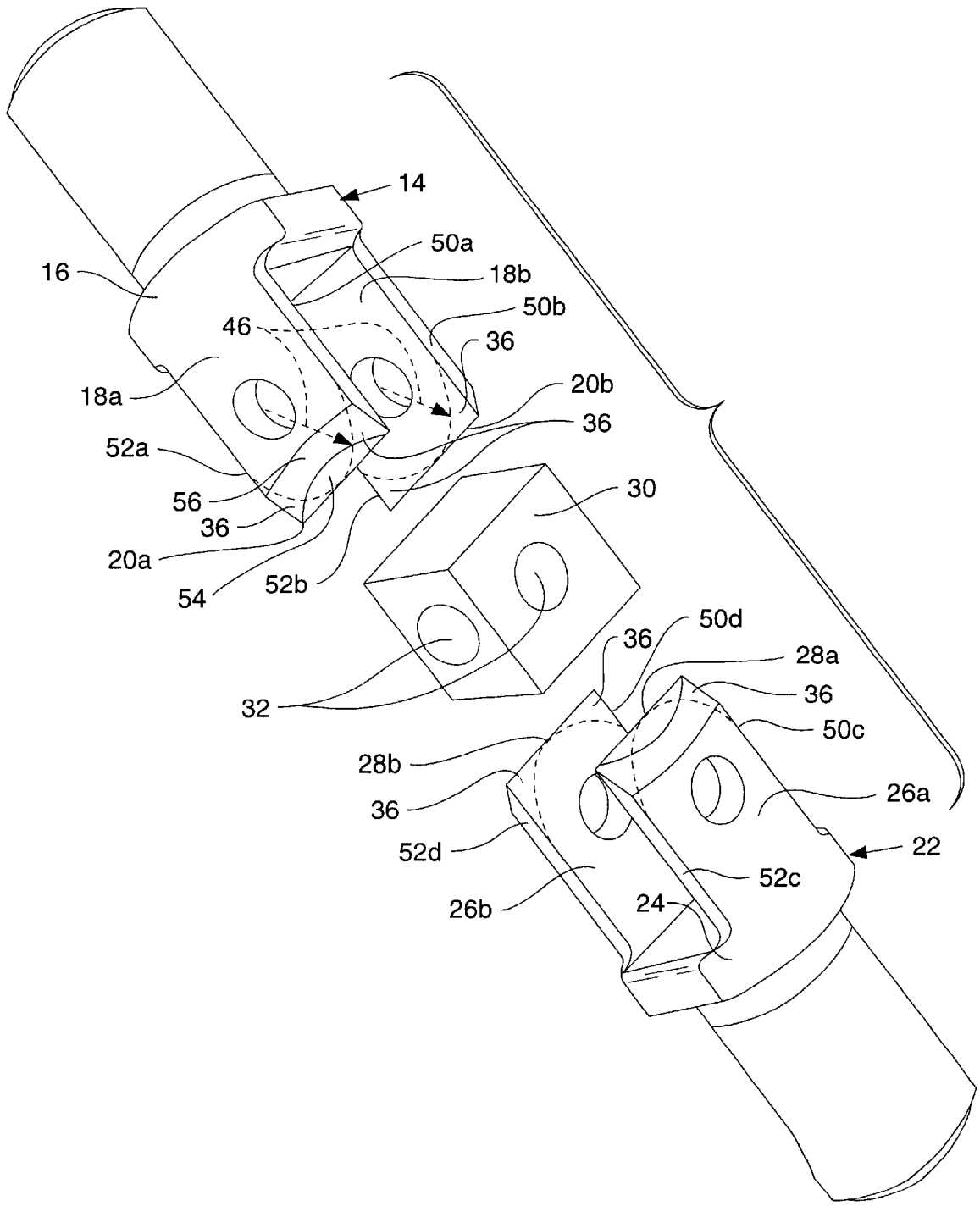
34
36
42 (1st AXIS)
44 (2nd AXIS)
46
50
52
54
82

FIG. 1

Fig. 2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26a
52d
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52c
26b
24

Fig. 3

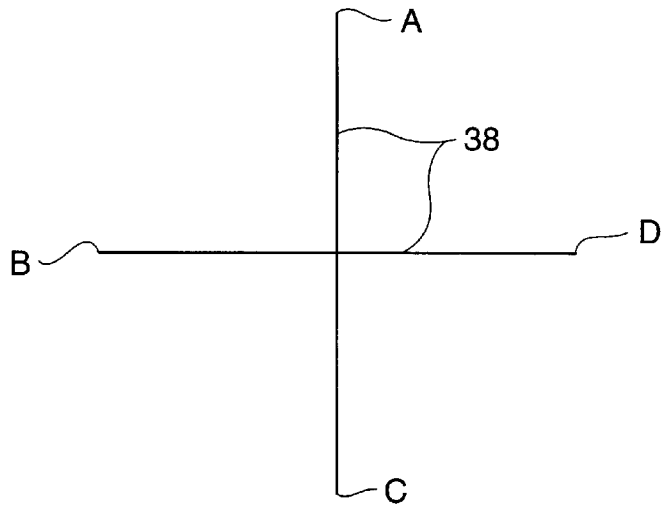


Fig. 6

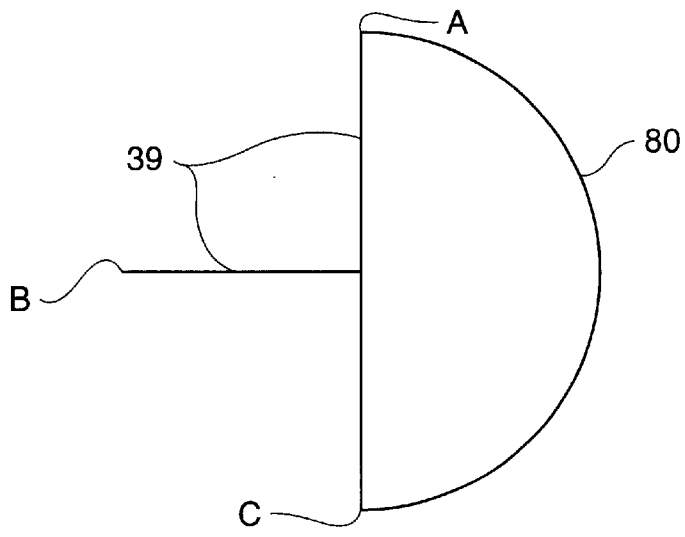
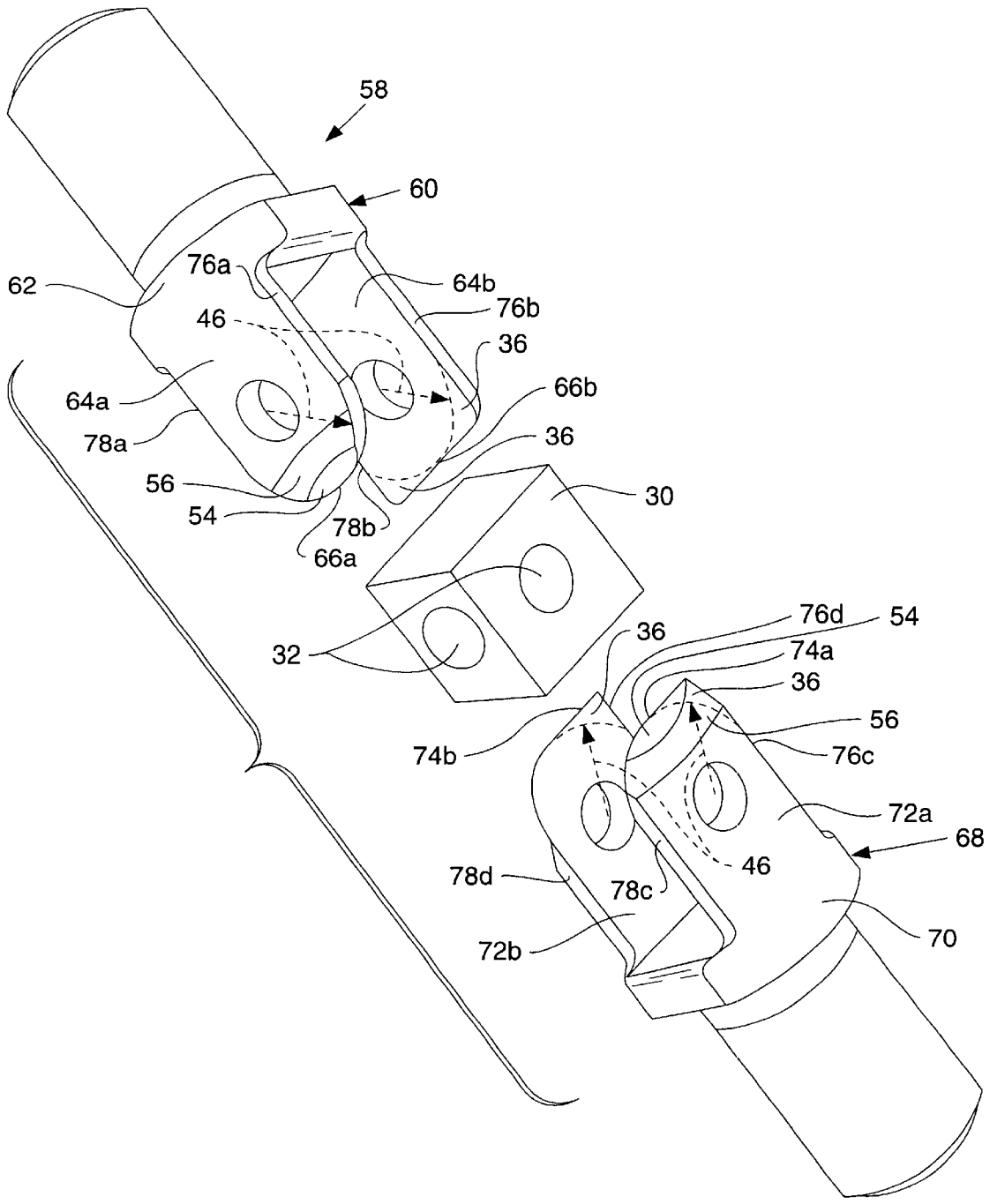


Fig. 4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60
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64b
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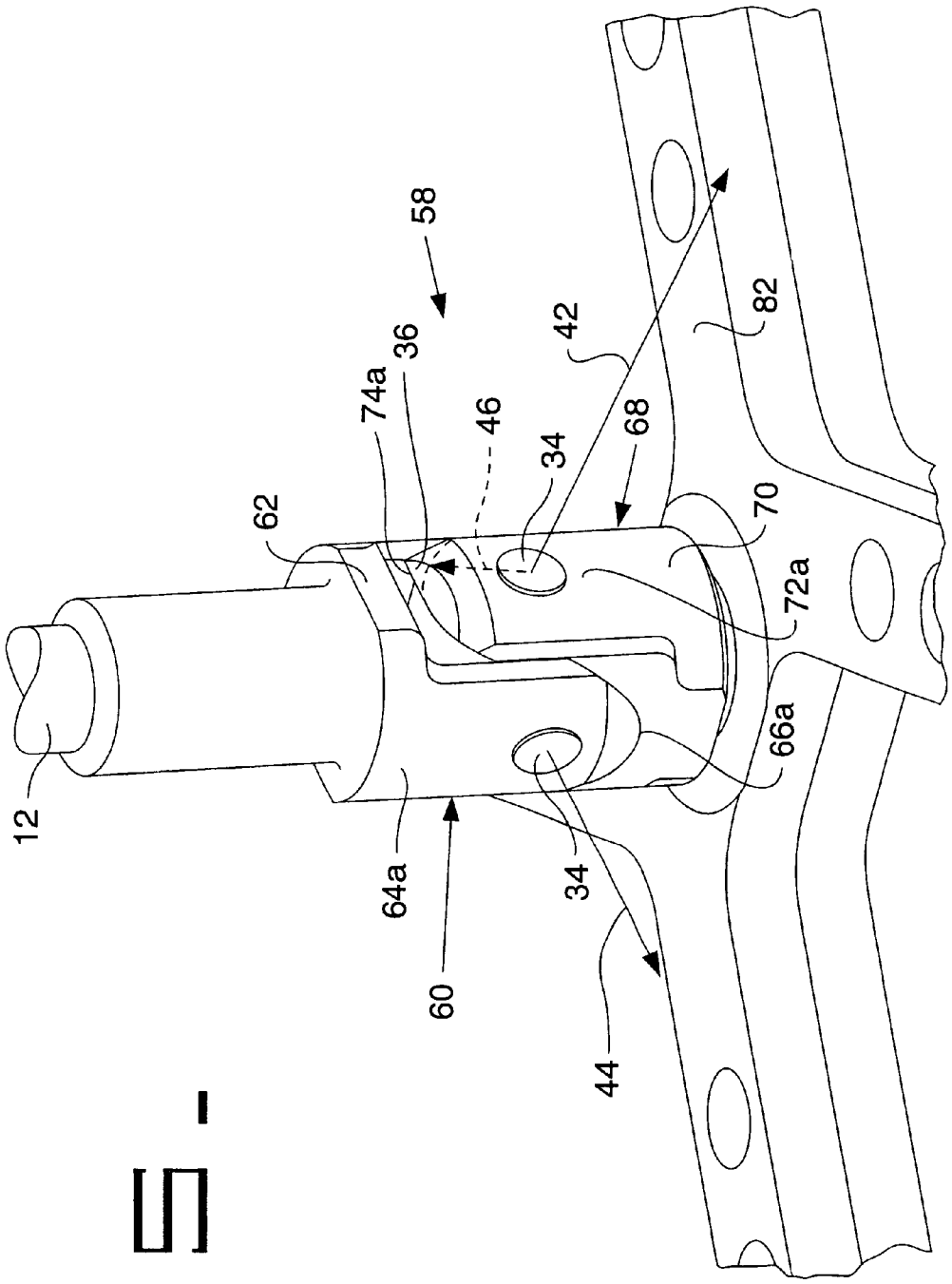

FIG. 5

SYSTEM FOR DEFINABLE SINGLE LEVER CONTROL SHIFT PATTERN JOINT

TECHNICAL FIELD

This invention relates generally to a single lever control assembly for controlling a machine and more particularly to a control shift pattern joint.

BACKGROUND ART

Single lever control assemblies of the type known for controlling a machine typically comprise two U-shaped members each having a base and parallel legs extending along spaced longitudinal axes from the base to respective distal ends, a lever supported by one of the U-shaped members, and a pivot block interconnecting the parallel legs. Typically, the range of motion of a single lever control assembly includes a plus pattern and 360° rotation, i.e., a swiveling motion.

The pivot block allows the U-shaped members to rotate relative to one another about transverse first and second axes to obtain the plus pattern. In other words, the parallel legs of the first U-shaped member rotate about the first axis when the legs of the first U-shaped member move between the parallel legs of the second U-shaped member. Also, the parallel legs of the first U-shaped member rotate about the second axis when the parallel legs of the first U-shaped member move about the legs of the second U-shaped member. The 360° of rotation occur because all the legs of the U-shaped members terminate within a radius of clearance about the axes.

Typically, single lever control assemblies rotate in a plus pattern and in a 360° pattern when viewed from above the single lever control assembly. Specific functions are activated and deactivated by moving the single lever control assembly to certain positions. Generally, a specific function is activated at each endpoint of the plus pattern. Two functions can be activated simultaneously by rotating the single lever control about the 360° pattern to the midpoint position between the two desired functions.

A disadvantage of using this type of single lever control assembly is that additional components need to be added to limit the range of motion of the lever assembly. Typically, a plate is used to limit the range of motion. For instance, the plate could be either flat or rounded and is placed over the single lever control assembly. Each plate includes a cutout portion or slot in the areas where movement of the single control lever is allowed or desired. One example of such an apparatus is disclosed in U.S. Pat. No. 4,133,251. In that example, the lever is movable laterally in two generally perpendicular directions via a slotted gate pattern.

Another disadvantage of this type of single lever control assembly is that there is an additional expense in manufacturing the plates. Yet another disadvantage is the time required to properly install such a plate. Finally, there is always the possibility that the plate will slip out of position resulting in unrestricted movement of the single lever control.

Therefore, it is desirable to limit the 360° motion of the single lever control assembly without requiring extra structural elements. The present invention is directed to overcome one or more of the problems as set forth above.

DISCLOSURE OF THE INVENTION

The invention relates to a single lever control assembly for controlling a machine. The single lever control comprises two U-shaped members each having a base and supporting spaced parallel legs, a lever connected to one of the U-shaped members, and a pivot block interconnecting the parallel legs of the two U-shaped members. The single lever control assembly is characterized by at least one of the legs of one of the U-shaped members having a projection engaging one of the parallel legs of the other U-shaped member to limit rotation.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of one embodiment of the single lever control assembly of the subject invention;

FIG. **2** is an exploded perspective view of the embodiment shown in FIG. **1**;

FIG. **3** is a top view of the range of motion of the embodiment shown in FIG. **1**;

FIG. **4** is an exploded perspective view of another embodiment of the subject invention;

FIG. **5** is a perspective view of the embodiment shown in FIG. **4**; and

FIG. **6** is a top view of the range of motion of the embodiment shown in FIG. **4**.

BEST MODE FOR CARRYING OUT THE INVENTION

Referring to the drawings where like numerals indicate like or corresponding parts throughout the several views, a single lever control assembly for controlling a machine is generally shown at **10**. A single lever control assembly is also commonly known as a joystick. The types of machines controlled by the single lever control assembly **10** of the present invention include, but are not limited to, loaders, excavators, tractors, winches and/or rippers.

As shown in FIGS. **1** and **2**, the assembly **10** comprises a single lever **12** and a first U-shaped member, generally indicated at **14**, having a base **16** supporting the lever **12**. Parallel legs **18**(*a*), **18**(*b*) extend along spaced longitudinal axes from the base **16** to respective distal ends **20**(*a*), **20**(*b*).

The assembly **10** also comprises a second U-shaped member, generally indicated at **22**. The second U-shaped member **22** also has a base **24** and parallel legs **26**(*a*), **26**(*b*) extending along spaced longitudinal axes from the base **24** to respective distal ends **28**(*a*), **28**(*b*).

As shown in FIG. **2**, a pivot block **30** interconnects the parallel legs **18**(*a*), **18**(*b*), **26**(*a*), **26**(*b*) for allowing the first U-shaped member **14** to rotate relative to the second U-shaped member **22**. Further, the pivot block **30** has a square cross-section and contains two transverse holes **32** for receiving pins **34** that connect the U-shaped members **14**, **22** to the pivot block **30**.

There is also typically an actuating plate attached to the first U-shaped member **22** (not shown). The actuating plate functions to engage respective valve elements responsive to movement of the single lever **12**. Engagement of the valve elements causes performance of desired functions associated with the machinery being controlled by the joystick.

The second U-shaped member **22** is stationary because it is connected to a base member that attaches to the machinery the lever is controlling. The base member is shown as an X-shaped support bracket **82** in FIG. **1**.

The single lever control assembly **10** is characterized by at least one of the parallel legs **18**(*a*), **18**(*b*), **26**(*a*), **26**(*b*) of one of the U-shaped members **14**, **22** having a projection **36** engaging one of the parallel legs **18**(*a*), **18**(*b*), **26**(*a*), **26**(*b*)

of the other U-shaped member **14**, **22** to limit rotation. The projection extends beyond the leg's **18**(*a*), **18**(*b*), **26**(*a*), **26**(*b*) radius **46** of clearance which is a reference radius that extends about the first and second axes **42**, **44**. It is recognized that the projection could have various shapes or contours to obtain various operating characteristics.

As discussed previously, a 360° pattern of the single lever **12** is achieved when the end **20**(*a*), **20**(*b*), **28**(*a*), **28**(*b*) of each leg **18**(*a*), **18**(*b*), **26**(*a*), **26**(*b*) terminates at or within the reference radius 46. In that case, each leg clears the parallel legs **18**(*a*), **18**(*b*), **26**(*a*), **26**(*b*) of the opposite U-shaped member **14**, **22** in all degrees of rotation between the U-shaped members **14**, **22**. In the prior art single lever control assemblies, the distal ends of all of the parallel legs terminate at or within the reference radius of clearance **46**. In the present invention, rotation of the single lever control assembly **10** is limited because at least one of the parallel legs has a projection **36** that extends, at least in part, beyond the reference radius **46**.

The plus pattern **38** illustrated in FIG. **3** is achieved when the first U-shaped member **14** is limited to rotate only relative to the second U-shaped member **22** about transverse first and second axes **42**, **44** (see FIG. **1**). The first U-shaped member **14** rotates about the first axis **42** when the parallel legs **18**(*a*), **18**(*b*) of the first U-shaped member **14** rotate between the parallel legs **26**(*a*), **26**(*b*) of the second U-shaped member **22**. The first U-shaped member **14** rotates about the second axis **44** when the parallel legs **18**(*a*), **18**(*b*) of the first U-shaped member **14** rotate about the parallel legs **26**(*a*), **26**(*b*) of the second U-shaped member **22**.

In the embodiment of FIGS. **1** and **2**, each of the parallel legs **18**(*a*), **18**(*b*), **26**(*a*), **26**(*b*) includes a reference radius of clearance 46 extending about the first and second axes **42**, **44**. Further, all four legs **18**(*a*), **18**(*b*), **26**(*a*), **26**(*b*) of the single lever control assembly **10** have at least one projection **36** to limit movement. In other words, there are a plurality of projections **36** extending beyond the reference radius **46**, each projection **36** on a different parallel leg **18**(*a*), **18**(*b*), **26**(*a*), **26**(*b*). Each projection **36** extends parallel to the longitudinal axis of the parallel leg **18**(*a*), **18**(*b*), **26**(*a*), **26**(*b*) of the projection **36** it extends from. Alternatively, the projection **36** extends transverse to the longitudinal axis of the parallel leg **18**(*a*), **18**(*b*), **26**(*a*), **26**(*b*). As previously noted, the projections **36** do not have to extend to a point as illustrated in the drawings. It is recognized that various contours could be used without departing from the essence of the subject invention.

Each parallel leg **18**(*a*), **18**(*b*), **26**(*a*), **26**(*b*) includes parallel spaced sides **50**(*a*), **52**(*a*), **50**(*b*), **52**(*b*), **50**(*c*), **52**(*c*), **50**(*d*), **52**(*d*) extending from the base **16**, **24** to a distal end **20**(*a*), **20**(*b*), **28**(*a*), **28**(*b*). As shown in FIG. **2**, in the first U-shaped member **14** leg **18**(*a*) includes parallel spaced sides **50**(*a*) and **52**(*a*) that terminate at distal end **20**(*a*). Leg **18**(*b*) includes parallel spaced sides **50**(*b*) and **52**(*b*) that terminate at distal end **20**(*b*). On the second U-shaped member **22**, leg **26**(*a*) includes parallel spaced sides **50**(*c*) and **52**(*c*) that terminate at distal end **28**(*a*). Leg **26**(*b*) includes parallel spaced sides **50**(*d*) and **52**(*d*) that terminate at distal end **28**(*b*). As shown in FIG. **1**, both sides **50**(*a*), **52**(*a*), **50**(*b*), **52**(*b*), **50**(*c*), **52**(*c*), **50**(*d*), **52**(*d*) of each parallel leg **18**(*a*), **18**(*b*), **26**(*a*), **26**(*b*) extend beyond the reference radius **46** to the leg's distal end **20**(*a*), **20**(*b*), **28**(*a*), **28**(*b*).

Each distal end **20**(*a*), **20**(*b*), **28**(*a*), **28**(*b*) extends in a straight line between the sides **50**(*a*), **52**(*a*), **50**(*b*), **52**(*b*), **50**(*c*), **52**(*c*), **50**(*d*), **52**(*d*) and is perpendicular to the longitudinal axis to provide a squared distal end **20**(*a*), **20**(*b*), **28**(*a*), **28**(*b*). Each squared distal end **20**(*a*), **20**(*b*), **28**(*a*), **28**(*b*) also preferably includes a beveled surface **54**. The squared distal end **20**(*a*), **20**(*b*), **28**(*a*), **28**(*b*) could also include an arcuate surface **56** adjacent the beveled surface **54**. As shown in the embodiment of FIG. **3**, the single lever control assembly **10** has only a plus pattern **38** range of motion. The projections **36** on each parallel leg **18**(*a*), **18**(*b*), **26**(*a*), **26**(*b*) prevent any rotation within the 360° range except that movement within the plus pattern.

Another embodiment is shown in FIGS. **4** and **5**. The assembly **58** comprises a single lever **12** and a first U-shaped member, generally indicated at **60**, having a base **62** supporting the lever **12**. Parallel legs **64**(*a*), **64**(*b*) extend along spaced longitudinal axes from the base **62** to respective distal ends **66**(*a*), **66**(*b*).

The assembly **58** also comprises a second U-shaped member, generally indicated at **68**. The second U-shaped member **68** also has a base **70** and parallel legs **72**(*a*), **72**(*b*) extending along spaced longitudinal axes from the base **70** to respective distal ends **74**(*a*), **74**(*b*).

As shown in FIG. **4**, a pivot block **30** interconnects the parallel legs **64**(*a*), **64**(*b*), **72**(*a*), **72**(*b*) for allowing the first U-shaped member **60** to rotate relative to the second U-shaped member **68**. Further, the pivot block **30** has a square cross-section and contains two transverse holes **32** for receiving pins **34** that connect the U-shaped members **60**, **68** to the pivot block **30**.

There is also typically an actuating plate attached to the first U-shaped member **60** (not shown). The actuating plate functions to engage respective valve elements responsive to movement of the single lever **12**. Engagement of the valve elements causes performance of desired functions associated with the machinery being controlled by the joystick.

The second U-shaped member **68** is connected to the base member that attaches to the machinery the lever is controlling. The base member is shown as an X-shaped support bracket **82** in FIG. **5**.

Each parallel leg **64**(*a*), **64**(*b*), **72**(*a*), **72**(*b*) includes parallel spaced sides **76**(*a*), **78**(*a*), **76**(*b*), **78**(*b*), **76**(*c*), **78**(*c*), **76**(*d*), **78**(*d*) extending from the base **62**, **70** to a distal end **66**(*a*), **66**(*b*), **74**(*a*), **74**(*b*). In the first U-shaped member **58**, leg **64**(*a*) includes parallel spaced sides **76**(*a*) and **78**(*a*) that terminate at distal end **66**(*a*). Leg **64**(*b*) includes parallel spaced sides **76**(*b*) and **78**(*b*) that terminate at distal end **66**(*b*). In the second U-shaped member **68**, leg **72**(*a*) includes parallel spaced sides **76**(*c*) and **78**(*c*) that terminate at distal end **74**(*a*). Leg **72**(*b*) includes parallel spaced sides **76**(*d*) and **78**(*d*) that terminate at distal end **74**(*b*).

In the subject embodiment **58**, the first parallel leg **64**(*a*) of the first U-shaped member **60** does not include a projection. Therefore, the distal end **66**(*a*) of the first parallel leg **64**(*a*) is at the reference radius of clearance **46** and has a semicircular distal end **66**(*a*). On the other hand, each side **76**(*b*), **78**(*b*) of the second parallel leg **64**(*b*) extends beyond the reference radius **46** to the leg's distal end **66**(*b*). The distal end **66**(*b*) extends in a straight line between the sides **76**(*b*), **78**(*b*) and is perpendicular to the longitudinal axis to provide a squared distal end **66**(*b*).

The first side **76**(*c*), **76**(*d*) of each parallel leg **72**(*a*), **72**(*b*) of the second U-shaped member **68** extends beyond the reference radius **46** to the leg's distal end **74**(*a*), **74**(*b*). In other words, each side **76**(*c*), **76**(*d*) includes a projection **36**. The second side **78**(*c*), **78**(*d*) of each parallel leg **72**(*a*), **72**(*b*) of the second U-shaped member **68** does not extend beyond the reference radius **46**. In other words, the second sides **78**(*c*), **78**(*d*) do not include projections.

The projections **36** on the legs **72**(*a*), **72**(*b*) of the second U-shaped member **68** are adjacent the second parallel leg **64**(*b*) of the first U-shaped member **60**. As a result of this configuration, the range of motion includes a T-shaped pattern **39** and 180° of unrestricted rotation **80**, as shown in FIG. **6**. To further facilitate this motion, the distal end **66**(*a*), **66**(*b*), **74**(*a*), **74**(*b*) of each parallel leg **64**(*a*), **64**(*b*), **72**(*a*), **72**(*b*) also includes a beveled surface **54**. The distal ends **66**(*a*), **66**(*b*), **74**(*a*), **74**(*b*) could also include an arcuate surface **56** adjacent the beveled surface **54**.

Of course, various modifications of this invention would come within the scope of the invention. The main fundamental concept is to limit the rotation of a single lever control assembly due to the inherent design of the mechanism.

INDUSTRIAL APPLICABILITY

In the embodiment shown in FIGS. **1** through **3**, the single lever control assembly is restricted to movement in a plus pattern. As shown in FIG. **3**, there are four endpoints A, B, C, D to the plus pattern. Further, there is a valve associated and aligned with each endpoint A, B, C, D. Moving the lever to a particular endpoint will actuate the associated valve. Actuation of a particular valve causes performance of a specific function. Typically, the valve is hydraulic.

In the embodiment shown in FIGS. **4** through **6**, the single lever control assembly is restricted to a T-shaped pattern and 180° of rotation. As shown in FIG. **6**, there are three endpoints to the T-pattern. There is a valve associated and aligned with each endpoint. Moving the lever to a particular endpoint will actuate the associated valve. There is also a valve associated with the point situated at the outer periphery midpoint of the 180° pattern. In other words, there is a valve situated 90° from endpoints A, C and 180° from endpoint B. Further, the lever can move freely within the 180° pattern. As the lever is moved within the 180° several functions can be performed simultaneously. For example, the function associated with the valve corresponding to the midpoint of A and C can be actuated simultaneously with the function associated with endpoint A or C.

The single lever control assembly of the present invention overcomes the disadvantages of the prior art single lever control assemblies because no additional components need to be added to control the shift pattern of the single lever control assembly. The shift pattern of the present invention is predetermined by the design of each component in the single lever control assembly. In other words, the shift pattern is inherent based on the shape of the single lever control assembly components.

Other aspects, objects and advantages of this invention can be obtained from a study of the drawings, the disclosure and the appended claims.

What is claimed is:

1. A single lever control assembly adapted for controlling a machine, said assembly comprising;

a lever,

a first U-shaped member having a base supporting said lever and parallel legs extending along spaced longitudinal axes from said base to respective distal ends;

a second U-shaped member having a base and parallel legs extending along spaced longitudinal axes from said base to respective distal ends;

a pivot block interconnecting said parallel legs for allowing said U-shaped members to rotate relative to one another about transverse first and second axes for allowing said parallel legs of said first U-shaped member to rotate about said first axis between said parallel legs of said second U-shaped member and for allowing said parallel legs of said first U-shaped member to rotate about said second axis with said parallel legs of said second U-shaped member therebetween;

a first of said parallel legs of said first U-shaped member having a projection engaging one of said parallel legs of said second U-shaped member to limit rotation of said lever about said second axis; and a first of said parallel legs of said second U-shaped member having a projection engaging one of said legs of said U-shaped member to limit rotation of said lever about said first axis.

2. An assembly as set forth in claim **1** wherein each of said parallel legs includes a reference radius extending about one of said first and second axes which would clear said parallel legs of the opposite U-shaped member in all degrees of rotation between said U-shaped members and said projection extends beyond said reference radius.

3. An assembly as set forth in claim **2** including a plurality of said projections each on a different parallel leg and extending beyond said reference radius.

4. An assembly as set forth in claim **2** wherein said projection extends transverse to at least one of said longitudinal axes.

5. An assembly as set forth in claim **2** wherein said projection extends parallel to at least one of said longitudinal axes.

6. An assembly as set forth in claim **5** wherein each said parallel leg includes parallel spaced sides extending from said base to said distal ends and at least one of said sides extends beyond said reference radius to said distal end.

7. An assembly as set forth in claim **6** wherein both of said sides of one of said parallel legs extend beyond said reference radius to said distal end.

8. An assembly as set forth in claim **7** wherein said distal end extends in a straight line between said sides of said one of said parallel legs.

9. An assembly as set forth in claim **8** wherein said straight line is perpendicular to at least one of said longitudinal axes to provide a squared said distal end.

10. An assembly as set forth in claim **9** wherein each of a plurality of said parallel legs includes a squared said distal end.

11. An assembly as set forth in claim **9** wherein said squared distal end includes a beveled surface.

12. An assembly as set forth in claim **11** wherein said squared distal end includes an arcuate surface adjacent said beveled surface.

13. An assembly as set forth in claim **6** wherein a first side of said parallel leg extends beyond said reference radius to said distal end.

14. An assembly as set forth in claim **13** wherein a second side of said parallel leg does not extend beyond said reference radius to said distal end.

15. An assembly as set forth in claim **6** wherein said distal end is squared at said first side and said distal end is rounded at said second side.

16. An assembly as set forth in claim **15** wherein said distal end includes a beveled surface.

17. An assembly as set forth in claim **16** wherein said distal end includes an arcuate surface adjacent said beveled surface.

* * * * *